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THE UNIDO PROGRAMME OF TECHNOLOGICAL ADVANCES:

MICROELECTRONICS

Note prepared by the

UNIDO Technology Programme*

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1. Following the Third General Conference of UNIDO in 1980, a major new programme was established in the Technology Programme of UNIDO dealing with the potentials and implications of technological advances for developing countries. Those advances are not only creating new industries but have substantial implications for a number of other industries. The convergence of these technological advances itself produces an interaction, which in turn has implications for the pattern and rate of industrial production in developing countries. In other words, in planning their industrial development and for achieving the Lima target,[1/] developing countries have to recognize that the present and coming decades are likely to witness substantial changes in production patterns owing to the expected interplay of the new advanced technologies. These technologies have potential as well as limitations for developing countries and it should be part of the industrial and technological strategy of each developing country to see how it can tap the potential of the new technologies without being affected by their limitations.

2. The Fourth General Conference of UNIDO which took place in Vienna from 2 to 19 August 1984 included an agenda item on the subject of strengthening the scientific and technological capabilities for industrial development in developing countries. In the debate on this item attention was drawn by the secretariat to the changing technological world scene and the consequent need for the developing countries to rectify past deficiencies and to come to grips with the new situation. As technological advances were expected to affect a wide range of industrial sectors, it was necessary for each country to reduce to a minimum the adverse consequences of those advances and to maximize their benefits through a selective and differentiated policy adapted to its own requirements. UNIDO's programme in microelectronics was commended and support was expressed for promoting the establishment of regional and international centres for selected technologies including the networking of existing institutions in the respective regions. Developing countries may identify gaps in existing arrangements with a view to considering setting up national, regional and interregional facilities and networking existing centres including research and development institutions.

1/ The Second General Conference of UNIDO, held at Lima, Peru, in March 1975, set a target of a 25 per cent share of world industrial production for the developing countries by the year 2000.

3. The Conference also recognized that the new technologies will have a wide-ranging impact on industrial development and endorsed the importance of strengthening scientific and technological capabilities for industrial development in developing countries; it urged UNIDO to assist developing countries in building their technological capabilities in different fields of technology including the setting up of national groups to monitor and assess technological trends and the changing international market and promote core groups or institutions in selected technological advances.

4. The concept of promoting specific projects for international co-operation aimed at the betterment of the life of the poorest of the poor, which had originally been formulated at the International Forum on Technological Advances at Tbilisi (USSR) in April 1983, was also presented to the Conference. Its objectives were generally supported and there was agreement that appropriate technologies including advanced ones should be promoted and developed to meet particular needs of a clear urgency to mankind. Microelectronics is a suitable candidate technology as it can be beneficially employed in health care for the rural poor; educational and information purposes in decentralized locations etc.

5. The UNIDO programme on technological advances was designed, in particular, to increase awareness through early identification and assessment and to promote action at national, regional and international levels regarding:

(a) The potential and limitations of various advanced technologies for the developing countries;

(b) The industrial and technological capabilities that the developing countries need in order to be able to use advanced technologies where appropriate and feasible;

(c) The policy actions to be taken by the Governments of developing countries with regard to advanced technologies.

6. In addition to expert group meetings, studies and current awareness bulletins, emphasis has been laid on:

(a) Mobilizing the co-operation of individuals and institutions at the cutting edge of a particular technology;

(b) Promoting national action by developing countries in terms of policies and programmes in accordance with their conditions and requirements;

(c) Providing technical assistance, as required by developing countries.

(d) identifying and promoting developing-country-specific applications as also application in various industrial sectors.

7. Activities have been developed within the framework of the foregoing considerations, bearing in mind the nature of the technological advances and the type of practical action that would be most effective in each case.

8. The position in regard to microelectronics is described below briefly, indicating the activities carried out at international, regional and national levels.

Actions by UNIDO at the international level

9. In June 1981 a meeting of experts was organized on the implications of technological advances in microelectronics for developing countries. The meeting emphasized the importance of actions at the national level relating to manufacture, industrial and other applications, software development and the formulation of a national microelectronics strategy. Actions at the international level were also recommended, including a continuous monitoring of observed trends and their impact on various sectors and the development of pilot projects and programmes dealing with applications and software.

10. Following the June 1981 meeting, a mission of experts visited four developing countries in different regions to promote selective applications of microelectronics and software development. Apart from reviewing the national situation in the countries visited, the mission recommended an approach to microelectronics application, including software and suggested models of microprocessor application centres and software houses. Also as a result of the June 1981 meeting, certain activities at the regional level were pursued. These are described in a later section.

11. The International Forum on Technological Advances and Development organized by UNIDO in Tbilisi, USSR in 1983 as well as expert meetings in Moscow, USSR (Dec. 1982), and Dubrovnik, Yugoslavia (June 1983), which respectively preceded and succeeded it, examined the subject of technological advances and development with regard to specific technologies of which

microelectronics was an important one. A suggestion was also made in the Forum that an international centre for microprocessor applications should be established; as a starting point for examining the various requests for regional and international action, a series of country case studies have been initiated, aimed at the national level, but also to identify the scope for regional and international co-operation. It is expected these studies will provide concrete information and meaningful approaches for regional and international action. Country studies published so far cover Bangladesh, Brazil, India, the Republic of Korea, Pakistan and Venezuela. An overview of the microelectronics industry in these countries has also been prepared.

12. In an effort to co-ordinate the activities of organizations and professional groups active in the area of information technology for development, the UNIDO secretariat convened a meeting in Vienna from 21 to 23 March 1984 which brought together representatives of these groups, identified possible areas of co-operation and considered a mechanism for keeping mutually informed and for formulating joint programmes. In addition to representatives of organizations, selected specialists from developing countries were also invited to present their countries' policies and requirements. As a result of this meeting a Consultative Group on Information Technology (COGIT) has been established which will meet periodically to review ongoing activities, exchange experience and formulate joint programmes. A directory of these groups and organizations will also be prepared by UNIDO which will be updated as new organizations join COGIT.

13. The UNIDO Secretariat has tried to promote the concept of software as an industry and the actions that developing countries could take to promote that industry. The concept has been elaborated through three studies dealing with the importance of software for developing countries; the approach to software development in those countries; and guidelines for software production. Further work in this area would include the promotion and development of software for specific applications of relevance to developing countries including applications in various industrial sectors. A report on the commercialization of software: main issues and contractual terms and conditions, was prepared and submitted to the Ninth Meeting of Heads of Technology Transfer Registries. Through these efforts and by other means it is proposed to build up a bank of application software for the benefit of developing countries.

14. Information technology, as covered by the term "informatics" and extending beyond data-bank systems and networks to industrial management tools and industrial processes, is in a stage of dynamic growth, particularly through the use of microprocessors. UNIDO co-sponsored a Conference on Informatics and Industrial Development with the Irish National Board for Science and Technology and Trinity College, Dublin, in March 1981. The Conference highlighted the importance developing countries attach to information developments, which are of substantial consequence to current industrial development strategies. This subject will be amplified at the future Intergovernmental Conference on Strategies and Policies for Information (SPIN). UNIDO will co-operate with the Intergovernmental Bureau of Informatics in the preparation of the Conference, which will address: the industrial applications of informatics; informatics as a sector of industry per se and hence of relevance to the Industrial and Technological Information Bank of UNIDO; and informatics as a feature of industrial technology in any sector of industry, a factor to be taken into account in the proper selection of advanced technology. UNIDO has also brought out a publication on informatics and industrial development.2/

Regional level activities

15. An Expert Group Meeting for the Economic Commission for Latin America and the Caribbean (ECLAC) region was held by UNIDO in June 1982 in Mexico, in co-operation with ECLAC, at which the socio-economic implications of micro-electronics advances for Latin American countries were analysed and a Co-operative Latin American Programme of Action in the field of microelectronics recommended. Follow-up action to draw up such a Co-operative Programme has been initiated by UNIDO and ECLAC.

2/ "Informatics for Industrial Development" (UNIDO/IS.415).

16. As a step in this direction a Latin American Microelectronics Network including the Caribbean (REMLAC) has been proposed following a high-level expert team mission to Venezuela in 1983. At the request of the Government, the experts looked at the facilities of an existing national institution in Venezuela with a view to upgrading it with UNIDO's assistance to become a nodal point for the proposed network. Other nodal points in different parts of the region will be identified. A meeting will take place in June 1985 in Caracas to establish REMLAC and to develop a programme of co-operation among the participating countries.

17. A request for assistance has been received from GEPLACEA (Group of Latin American and Caribbean Sugar Exporting Countries) which covers approximately 700 sugar mills in 21 member countries, for assistance in the introduction of microcomputers for optimization of production without too much additional investment. A pilot project will be implemented at a place selected and, if successful, the procedures, software and computing configuration could be utilized for other cane sugar producers.

18. A symposium on Microelectronics for Productivity held at New Delhi in April 1983 and co-sponsored by UNIDO requested UNIDO to take the lead in the promotion of the establishment of an Asian Centre for Electronics. National level studies in selected Asian countries have been undertaken to ascertain the needs for regional co-operation.

19. UNIDO has also co-operated with the Economic Commission for Western Asia (ECWA) in the preparation for and conduct of the Expert Group Meeting on the Development of Microelectronics in the ECWA region, 4-7 March 1984, Kuwait. Recommendations made at that meeting requested UNIDO inter alia to look into the possibility of establishing a silicon foundry with design facilities in the ECWA region. A UNIDO consultant undertook a preliminary mission in December 1984 which will be followed up by an in-depth study of the potentiality of future products in the countries of the region to assess the scope and potential in the region of the local manufacturing. Another co-operative effort between ECWA and UNIDO is the promotion of a CAD/CAM programme and its introduction in industry in the region. A report has been prepared by a UNIDO consultant.

20. In regard to Africa, UNIDO co-sponsored with UNCSTD, OAU and ECA a meeting of African scientists on the implications of new technologies in the implementation of the Lagos Plan of Action and the programme for the Industrial Development Decade for Africa. The meeting was held in Mbabane, Swaziland, from 22 to 26 October 1984.

21. A national meeting on applications of microelectronics and software is being organized by UNIDO in Kenya and will take place from 18 to 23 February 1985. Representatives from countries of the region such as Ethiopia, Sudan, Tanzania, Uganda and Zambia will also attend. Members of COGIT will participate as observers and sponsor an exhibition of their activities and specific products developed by them.

National level activities

22. At the national level, apart from the state-of-the-art studies commissioned, the UNIDO secretariat has been assisting the Mexican Government in setting up a permanent national team to monitor technological advances through a project financed by the UNFSSTD. Under this project a national level workshop was held. Thereafter three experts specifically looked at the microelectronics industry in its several aspects and suggested, in the light of the technology trends in the world, the actions that the Mexican Government could pursue.

23. A number of technical assistance projects are being implemented by UNIDO in this field and an illustrative list of these projects is in Annex I.

24. Other activities in this field include: support to a training workshop in Brazil; studies on biomedial applications and power devices prepared on the basis of that workshop; a pilot project for a rural development information system in the state of Karnataka, India; and a field study on computerization of small scale sector industry in India. A study on the use of computers for the organization of meat production and processing based on the experience gained from the system in the Philippines is under preparation.

Relevant publications isssued by UNIDO

25. The impact of microelectronics has been looked at in UNIDO's programme of industrial studies from the point of view of restructuring world industry. Two studies have been completed: "The impact of microelectronics on the international economic setting: the case of computer-aided design"[3/] "Restructuring world industry in a period of crisis - the role of innovation: an analysis of recent developments in the semi-conductor industry".[4/]

26. A quarterly bulletin, the Microelectronics Monitor, has been published since January 1982 to create awareness and provide current information to a target audience of policy-makers, scientists and technologists, particularly in developing countries. A survey of technological and market trends during 1982 - 1983 has been published by the Monitor.[5/] A special supplement reviewing developments in flexible manufacturing systems (FMS) will be published in February 1985.

27. A comprehensive list of documents published so far by the Technology Programme of UNIDO with regard to microelectronics is attached as Annex II.

3/ UNIDO/IS.297

4/ UNIDO/IS.285

5/ UNIDO/IS.438

Annex I

List of relevant operational technical assistance projects implemented by UNIDO

COUNTRY	PROJECT NUMBER	PROJECT TITLE
Albania	DP/ALB/84/001	Electronic instrumentation, automation and process control development
Brazil	SI/BRA/82/803	Micromechanics/microelectronic interfaces
Bulgaria	DP/BUL/81/002	Strengthening of the Institute for Industrial Cybernetics and Robotics
	DP/BUL/81/008	'Numerical control/computer aided manufacturing (NC/CAM) Metalworking Development Centre' (phase II)
	DP/BUL/81/009	Advanced manufacturing and engineering methods
	DP/BUL/82/001	Automated Production Instrumentation Centre (A.P.I.C.)
	UC/BUL/84/117	Assistance to the introduction of micro-electronics in industry
Czechoslovakia	DP/CZE/77/003	Assistance in computer aided design (CAD) and computer aided manufacturing (CAM) in machinery building industries
Democratic People's Republic of Korea	DP/DRK/79/003	Establishment of a pilot plant and training centre for bipolar digital integrated circuits
	DP/DRK/81/010	Numerically controlled machine tools, equipment and methods
	DP/DRK/81/016	Assistance to the Institute of Automation in computerized technology for automation in industrial applications
	DP/DRK/84/001	Development of numerically controlled machine-tools

COUNTRY	PROJECT NUMBER	PROJECT TITLE
Egypt	DP/EGY/78/003	Electronic Industries Research and Development Centre (phase II), electric machinery and equipment
Hungary	DP/HUN/82/003	Introduction of computer aided design training and education
India	DP/IND/81/025	Development of microprocessor based agro-dairy instruments
	DP/IND/82/024	Microprocessor application engineering programme
	DP/IND/82/033	Computer aided design programme
	DP/IND/82/034	Appropriate automation promotion programme
	DP/IND/84/015	Semiconductor devices and electronics sub-systems for transportation
	DP/IND/84/030	Microprocessor application engineering programme
	UC/IND/84/184	Electronics PCB Development
People's Republic of China	DP/CPR/80/050	Training and development of microcomputer systems application
Poland	RP/POL/84/001	Computer graphics implementation into the computer aided design and computer aided manufacturing in the Polish machine building industry
Republic of Korea	DP/ROK/75/019	Semiconductor materials technology
	DP/ROK/82/026	Mechanical engineering computer application (MECA) programme (application of CAD/CAM techniques in mechanical industries)
	DP/ROK/82/031	Numerical control centre
Interregional	UC/INT/84/125	Group training programme in computer aided design (CAD) and in computer aided manufacturing (CAM), Prague, CSSR, 10 - 29 September 1984

Annex II

List of documents published by the UNIDO Technology Programme on the Implications for developing countries of advances in microelectronics

Expert Group Meeting on Implications of Technological Advances in Microelectronics for Developing Countries, Vienna, 10-12 June 1981

IS.246 and Corr. 1	Implications of Micro-Electronics for Developing Countries: A Preliminary Overview of Issues.
UNIDO/IS.242/ Rev.1 and Corr.1	Report on Exchange of Views with Experts on the Implications of Technological Advances in Micro-Electronics for Developing Countries, Vienna, Austria, 10-12 June 1981.

UNIDO/ECLA Expert Group Meeting on Implications of Microelectronics for Developing Countries, Mexico, 7-11 June 1982

ID/WG.372/1	Prospects of Microelectronics Application in Process and Product Development in Developing Countries by Michael Radnor
ID/WG.372/2	Microelectronics and Government Policies: The Case of a Developed Country by Ernest Braun, Kurt Hoffman and Ian Miles.
ID/WG.372/3	Microprocessors and Productivity: Cashing in our Chips by Robert T. Lund.
ID/WG.372/4	Microelectronics and Telecommunications in Latin America by Edgardo Galli.
ID/WG.372/5 and Corr.1	Microelectronics: Its Impact and Policy Implications by Juan F. Rada.
ID/WG.372/6	Potential Applications Suitable for Microprocessor Implementations: Some Illustrative Possibilities by James Oliphant
ID/WG.372/10	Elements for the Formulation of a Regional Programme of Action in the Area of Microelectronics by Carlos Aguirre and Roberto Heredia
ID/WG.372/11	Telecommunications and Microelectronics: Some Observations by E. Galli, M. Welch and R. Herrera.
ID/WG.372/12	The Development of Microelectronics in Argentina by O. Filipello and R. Sagarzazu.
ID/WG.372/13	Cultural Aspects of Microelectronics Technology by Carlos I.Z. Mammana.
ID/WG.372/14	Microprocessor Applications and Industrial Development by Robert T. Lund.

ID/WG.372/15	Microelectronics and the Development of Latin America: Problems and Possibilities for Action by ECLA/UNIDO Joint Industry and Technology Division and Eugenio Lahera and Hugo Nochteff.
ID/WG.372/16	Microelectronics in Peru. Country Monograph by R. Herrera.
ID/WG.372/17	Report, UNIDO/ECLA Expert Group Meeting on Implications of Microelectronics for the ECLA Region, Mexico City, Mexico 7-11 June 1982

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UNIDO/IS.230	Technological Perspectives in Machine Tool Industry with special Reference to Micro-Electronics Applications by S.M. Patil.
ID/WG.384/5/ Rev.1	Microelectronics and Developing Countries: Towards an Action-oriented Approach.
ID/WG.401/6	Some Considerations About a Practical Approach to the Development of Technical Infrastructure for Microelectronics by G. Fernandes de La Garza.
UNIDO/IS.331	Prospects of Microelectronics. Application in Process and Product Development in Africa by Michael Radnor.
UNIDO/IS.338	Proceedings of the First Meeting on Co-operation between Scientific and Industrial Sectors in Microelectronics held at Mexico City, 14 and 15 June 1982.
UNIDO/IS.351	Microprocessor Applications for Developing Countries by James Oliphant.
UNIDO/IS.383	Problems of Software Development in Developing Countries.
UNIDO/IS.392	The Impact of Microelectronics on Biomedical Applications in Developing Countries by Cor. L. Claeys.
UNIDO/IS.415	Informatics for Industrial Development by Richard J. Nolan.
UNIDO/IS.438	Technology and Market Trends in the Production and Application of Information Technology by John Bessant
UNIDO/IS.439	Guidelines for Software Development in Developing Countries by R. Narasimhan
UNIDO/IS.440	Guidelines for Software Production in Developing Countries by H. Kopetz
UNIDO/IS.444	A Silicon Foundry to Service Developing Countries' Needs: A Preliminary Approach by the UNIDO secretariat

UNIDO/IS.446	Software Engineering: A Survey by W. Turski
ID/WG.419/1	Microelectronics Applications for Developing Countries: Preliminary Issues for Concerted Action
ID/WG.419/13	Report of Discussion Meeting on Information Technology for Development
UNIDO/IS.489	State-of-the-Art Series on Microelectronics No. 1 Venezuela No. 2 India No. 3 Republic of Korea No. 4 Pakistan No. 5 Bangladesh
UNIDO/IS.500	Overview of the Microelectronics Industry in Selected Developing Countries by S.E. Lalor